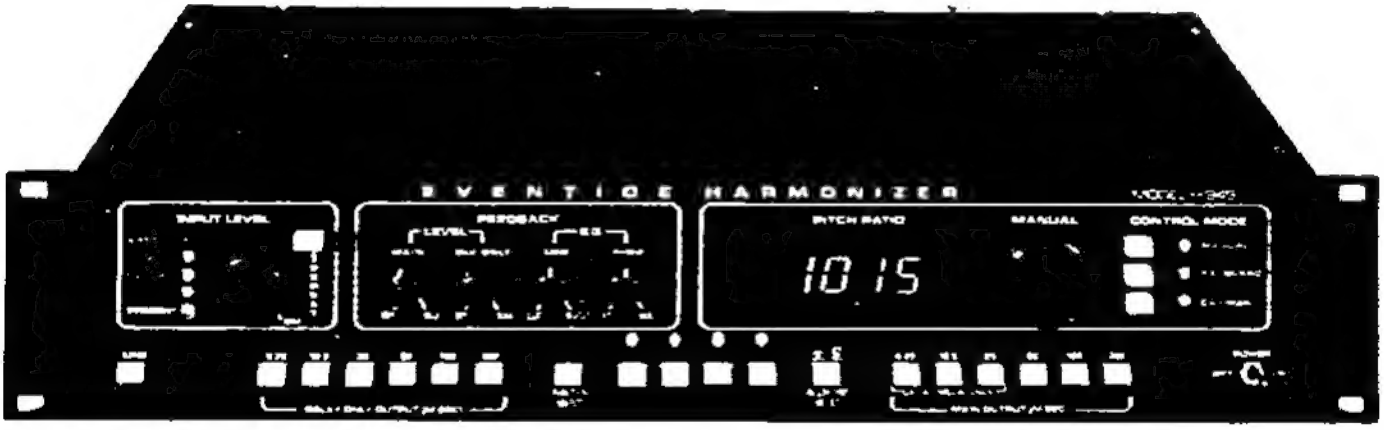
Eventide
the next step

H949
HARMONIZER

INSTRUCTION MANUAL



EVENTIDE CLOCKWORKS, INC • 265 WEST 54TH STREET • NEW YORK, N Y 10019 • 212-581-9290
PRINTED IN U.S.A

LIMITED WARRANTY

ALL EVENTIDE EQUIPMENT IS WARRANTED FOR A PERIOD OF ONE YEAR

from the date of purchase from Eventide or an authorised dealer, against defects in material or workmanship. In case of difficulty, consult Eventide or your dealer for instructions.

This warranty does not apply to mechanical defects caused by use or rough handling, or to damage caused by improper operation not in accordance with this manual. Cause of defect is in the sole judgement of Eventide. There are no other express or implied warranties, and no warranty of merchantability or fitness for a particular purpose.

The warranty is voidable at Eventide's option under the following circumstances:

- if the equipment is connected to an improper voltage supply.
- if the user makes unauthorized modifications of any type. If such modifications are made, user agrees to pay for any time or parts necessary to remove the modification before repair.

Eventide will under no circumstances be responsible for consequential damages caused by failure of equipments of its manufacture, or for any other reason. Our sole liability is for repair or replacement of defective parts, under the terms of the warranty.

SHIPPING

Equipment should be returned, if possible, in the original packing container. Loose cards must be wrapped in conductive foil (damage caused by failure to do this will render the warranty void). If the original container is not available, the equipment must be packed to prevent damage from crushing or dropping. Damage caused by inadequate packing for service return is not covered by warranty. We recommend shipping via UPS rather than by US mail, and air freight if you are in a hurry. If in our opinion the packing container is inadequate for return shipment, we reserve the right to supply a new container and charge for same.

The warranty covers return shipping in the continental US except Alaska. Return shipments will not be insured unless the customer requests and agrees to pay for same. If a more expensive form of shipment is requested, customer will be charged for same.

ALL RETURNED UNITS, IN OR OUT OF WARRANTY, MUST BE PREPAID TO OUR DOOR.

ALL RETURNED UNITS MUST BE ACCOMPANIED BY A COMPLETE TROUBLE REPORT, DETAILING ALL THE PROBLEMS EXPERIENCED, CONDITIONS OF OPERATION, ETC.

FOREIGN SHIPMENTS

Foreign shipments must be returned fully prepaid, including Customs and brokerage charges. Repaired equipment will be shipped all charges collect. A commercial invoice stating 'goods of US manufacture - being returned for repair' and giving a fair market value of the unit should accompany the shipment, to save time and expense. A copy of this invoice should also be mailed to Eventide.

REPLACEMENT OF PARTS UNDER WARRANTY will be done free of charge provided that the defective parts and the warranty card for the unit are received by Eventide.

Eventide's harmonizer model H949

ONE OCTAVE UP, TWO OCTAVES DOWN PITCH CHANGE

TWO OUTPUTS, EACH WITH UP TO 400 MILLISECONDS OF DELAY

MICRO PITCH CHANGE, FOR EXTREMELY PRECISE, STABLE SETTINGS

LONG DELAY PERMITS SIMULATED REVERB FREQUENCY RESPONSE 15 KHZ

TIME REVERSAL * REPEAT * FLANGING * RANDOMIZED DELAY

95 DB DYNAMIC RANGE HIGH AND LOW FEEDBACK EQUALIZATION

TWO SELECTABLE ALGORITHMS, TO OPTIMIZE PITCH CHANGE PERFORMANCE

DUAL COLOR LED'S FOR FRONT PANEL READABILITY

SWITCHABLE 115/230 VOLTS

'... an almost endless variety of functions.' (Broadcast Management/Engineering)
'... a new collection of effects at a most moderate cost.' (Studio Sound)

The Eventide model H949 Harmonizer is a combination digital delay line, pitch changer, and all-round special effects unit. The TIME REVERSAL feature is entirely new. When used with a variable-speed tape recorder, the Harmonizer is capable of shortening or lengthening a piece of program material to fit a given time slot, without altering the pitch. The H949 is built to professional industry standards, using random access memories (RAM's) for high quality, dependable performance.

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NEW YORK, N Y 10019 • 212-581-9290

Eventide specifications:

MODEL H949 HARMONIZER

INPUT CHARACTERISTICS	Impedance nominal 10 k, balanced, maximum level +24 dBm. Level for full dynamic range is from -10 dBm to +24 dBm.
OUTPUT CHARACTERISTICS	Impedance nominal 150 ohms. Suitable for driving 600 ohms or greater at +18 dBm. Electronically balanced.
DISTORTION	Less than .15% at 1 kHz, reference output level.
DYNAMIC RANGE	Greater than 96 dB from clipping to noise floor.
PITCH VARIATION	1 octave up, 2 octaves down, continuously variable. Four-digit readout indicates precise ratio.
DELAY	Main output - in Pitch Change mode: 0 to 300 ms in 50 ms steps. In Delay mode: 0 to 393.75 ms in 6.25 ms steps. Delay Only output: 0 to 393.75 ms in 6.25 ms steps.
FREQUENCY RESPONSE	At any delay, unity pitch ratio: 20 Hz to 15 kHz, ±1 dB. No degradation with increasing delay.
SIZE	Requires 8.89 cm (3½") x 48.26 cm (19") panel space. Extends 29.85 cm (11-3/4") behind panel.
POWER REQUIREMENTS	Switchable between 115 VAC (105 - 120 VAC), 50 - 60 Hz, and 230 VAC (220 - 240 VAC), 50 - 60 Hz. Nominal power dissipation 45 watts.
REMOTE CONTROL	Provision has been made for control by microcomputer using the IEEE standard interface bus (IEEE 488/1975). The HK940 keyboard can be used to control the pitch ratio in discrete musical steps. Option 05 mono keyboard controls one Harmonizer; option 06 polyphonic keyboard controls up to three Harmonizers. An input is provided to phase-lock the Harmonizer to any synthesizer. A 3 volt peak-to-peak signal is required. The pitch may be varied by a control voltage input in the 5 to 15 volt range (internally selected).

CAUTION WARNING BEWARE CAVEAT EMPTOR WATCH OUT READ THIS NOTICE N.B.

Like all pitch changers using time speed-up/slow-down techniques, the Harmonizer produces certain artifacts or 'glitches' in the output during pitch change operation. The relative audibility and severity of these artifacts depend upon many factors, including the pitch ratio and the nature of the program material. The Model H949 Harmonizer has been designed with two different algorithms, allowing the user to choose which sounds best for the particular application. Because judgement of the performance of the Harmonizer is, in the final analysis, very subjective, we suggest that you try the Harmonizer before buying one.
This warning does not apply to the Delay mode, in which the unit works just fine.

TABLE OF CONTENTS

There is a separate Technical Section, with its own Table of Contents.

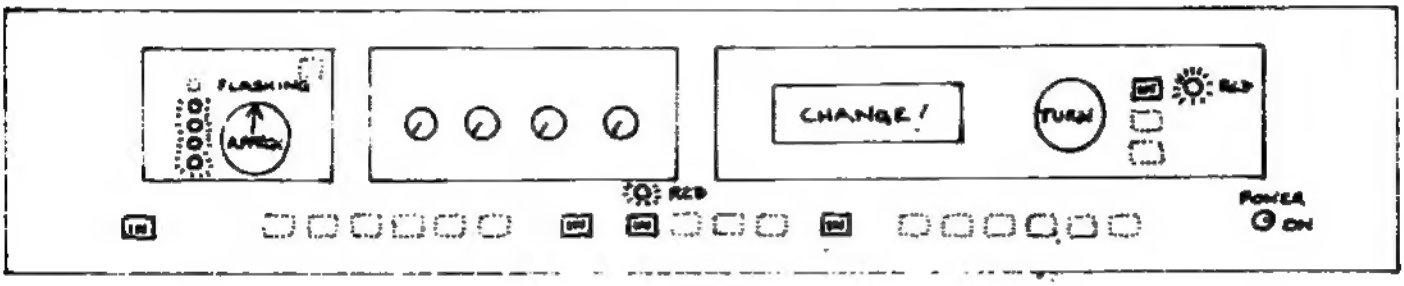
INTRODUCTION

The Eventide model H949 Harmonizer has a great many functions and modes of operation, which may seem confusing at first. We recommend that you spend some time familiarizing yourself with the different things the unit can do.

INSTALLATION The H949 will operate best in a well-ventilated location. If the unit is going to be subject to vibration (when traveling, for example) we recommend some support for the rear of the unit, not just rack mounting.

LINE VOLTAGE See section below. It is very easy to change the H949 from 115 to 230 volts. Remember that while applying 115 volts to a unit set for 230 will not hurt it (it won't work, though), applying 230 volts to a unit set for 115 may well prove disastrous. Check again when the unit goes along on your world tour.

CONNECTION The Harmonizer needs to be supplied with line level - if you are feeding it from a microphone, guitar, or similar, you will need a pre-amp. Connect the AC power cord, the input and output connectors, then set the front panel controls as shown below. This is a simple setting which will enable you to change the pitch of the input signal by turning the MANUAL knob. After that - experiment!



CONTROL DESCRIPTION

This section describes the various operating controls and front panel indicators of the Harmonizer model H949. Because of the large number of operating modes, many of the controls have multiple functions, and interact in unexpected ways. To avoid multiple cross references, the multimode controls may be partially described under more than one heading. Please be sure to read and understand the operation of all the operating controls before using the Harmonizer.

POWER ON/OFF

CAUTION: Before operating this control, be sure that the Harmonizer is set to the AC power line voltage appropriate for your location. As detailed in the Specifications, the 949 will operate at 115 VAC (105 - 120 VAC) and 230 VAC (220 - 240 VAC). If your local line voltage is consistently lower than these ranges, a step-up transformer may be necessary. If your local power line is subject to significant fluctuations, it will be advisable to use a voltage regulating transformer.

The POWER control applies AC power to the Harmonizer. No power is consumed when in the OFF position.

LINE IN/OUT

This control switches the Harmonizer IN and OUT of the audio circuit to which it is connected. When the control is IN (physically depressed), the Harmonizer INPUT is connected to the internal circuitry, and the two OUTPUTS are connected to their respective output amplifiers. When the switch is OUT the Harmonizer INPUT is directly connected to the two OUTPUT jacks and all the Harmonizer circuitry is bypassed.

Note that in the OUT position power need not be applied to the unit for signal to pass through. This is a useful diagnostic tool if a malfunction is suspected. If no signal is heard in the OUT position, it is almost certainly caused by defective external wiring.

INPUT LEVEL CONTROL AND INDICATOR GROUP

The INPUT LEVEL control is used to set the optimum operating level for the Harmonizer. The control operates as a conventional "volume" control, increasing signal level as it is rotated further clockwise.

The LEVEL INDICATOR GROUP of 5 Light Emitting Diodes (LED's) provides a visual cue as to the whether the LEVEL control is set correctly. The lowest, yellow LED indicates that a signal is being applied to the input. It comes on at approximately 40dB below clipping. The three green NORMAL LED's become illuminated at various levels below clipping, and indicate that a proper driving signal is present at the Harmonizer input. The red LIMIT indicator becomes illuminated within 1dB of clipping, and indicates that the input signal has instantaneously exceeded the clipping threshold. Note that all of these indicators are peak responsive, and will light on "peaky" material even though the average signal level may be quite low.

The INPUT LEVEL control should ideally be set at a point where the input signal drives all three green LED's, but never flashes the LIMIT indicator.

REPEAT CONTROL

This locking push button control is used to CAPTURE and REPEAT the data stored in the Harmonizer's digital memory. It is included in the INPUT control block because it, in effect, cuts off the external input signal and supplies an internal one instead. Depressing the control causes all data in the memory to remain and recirculate indefinitely, either until the REPEAT mode is exited, or power turned off.

When in the REPEAT mode, the action of the LEVEL INDICATOR LED's is reversed, so that as the input signal amplitude increases, the LED's become progressively extinguished. This provides a continuing indication of the input signal level while reminding the user that the REPEAT mode is in effect and the actual signal input is being disregarded.

When attempting to "capture" a particular signal segment with the REPEAT control, remember that the signal segment captured is that which is present in the memory at the instant the switch is depressed. If you are listening to a delayed output, part or all of the signal segment you heard immediately prior to depressing the control will be lost, depending upon the delay setting. For this reason, one should monitor either the input signal, or an undelayed output when attempting to capture specific words or segments.

FEEDBACK CONTROL GROUP

This group of controls routes a portion of the two output signals back to the input amplifier. The output of this group mixes with the signal obtained from the INPUT jack, but is independent of the gain adjustment provided by the INPUT LEVEL control. The gains are normalized so that with EQ controls approximately centered, the feedback level varies from 0 to 100% (loop gain of unity or "infinite" sustain) as either of the LEVEL controls is varied from OFF to MAX. The individual controls work as follows:

The MAIN LEVEL control adjusts the feedback from the MAIN (pitch change/effect) output to the input.

The DLY ONLY LEVEL control adjusts the feedback from the DELAY ONLY output to the input. The outputs from both the MAIN and DLY ONLY LEVEL controls are mixed and applied to the EQ controls, which control the frequency response of the feedback chain.

The LOW EQ control adjusts the relative level of bass frequencies present in the feedback mix. When rotated counterclockwise, lows are cut; when rotated clockwise, they are boosted.

The HIGH EQ control has a corresponding effect on higher frequencies. When both controls are centered, the frequency response of the feedback chain is approximately flat.

The actual frequency corners and rolloff curves are available in the specifications section of this manual. Please note that one can set the FEEDBACK controls, deliberately or otherwise, to a point where loop gain exceeds 1 at various frequencies. It is possible, and even easy to obtain uncontrolled oscillation. For this reason, it is suggested that the operation of the FEEDBACK group be undertaken cautiously until the user is fully familiar with the possibilities for interaction of the various controls.

DELAY ONLY OUTPUT (MSEC) SWITCH GROUP

This group of switches controls the delay time of the DELAY ONLY output. Each switch is a push/ON push/OFF control which is active when the button is depressed. The numbers above each switch represent the number of milliseconds (1/1000 second) added to the time delay when that switch is active. For instance, if buttons 1, 2, and 6 are in and buttons 3,4, and 5 are out, the time delay at the DELAY ONLY OUTPUT would equal 6.25ms+12.5ms+200ms, or 218.75 milliseconds.

The switches may be activated in any combination. The maximum obtainable delay is equal to the sum of all the switches, 393.75 milliseconds, or about four tenths of a second. Setting the delay of the DELAY ONLY OUTPUT has no effect on, and is not affected by, any settings of the delay or mode controls associated with the MAIN OUTPUT.

PITCH CONTROL/READOUT GROUP

This block of controls is associated primarily with the manual/remote control of the output pitch ratio of the MAIN OUTPUT vs. the input signal. Only the general function of the controls will be described here as the precise function varies depending upon the operating mode set by the FUNCTION SELECT switch group.

The MANUAL pitch ratio control is an analog control which sets the Harmonizer to the desired pitch ratio. In the NORMal pitch change mode, the range of this control is approximately 2 octaves down (decreased pitch) to 1 octave up. This control also determines the rate of delay change in the FLANGE and RANDOM modes. See the table following this section for the range of this control in the various operating modes.

The PITCH RATIO indicator is a four digit LED display which, in all modes other than DELAY, shows the numerical pitch ratio between the INPUT and the OUTPUT. This ratio may be converted to musical intervals (thirds, fifths, etc.) by reference to the table in the appendix. As with the MANUAL control, its range varies depending upon the FUNCTION SELECTed. It also provides additional information in the FLANGE and RANDOM modes by giving a visual indication of the operation and rate of both functions.

Note that this readout is, in effect, a digital measuring instrument and may, absent malfunction, be relied upon to be absolutely correct plus or minus one least significant digit (.1%). The readout is also useful in calculating time speed-up and slow-down ratios when one desires to keep pitch constant and change the length of a tape recording. In such cases, proper pitch correction is obtained by setting the readout to the reciprocal of the tape speed ratio. Again, see the Appendix for information on performing these calculations.

The CONTROL MODE switch group permits selection of an EXTERNAL pitch control source. Depressing the MANUAL switch permits the MANUAL control to operate as just described. Depressing the CV+MAN switch permits summing a Control Voltage (input via the rear panel terminal block) with the MANUAL control. (Rear panel inputs are described in a later section).

Depressing the KEYBOARD switch permits phase locking the pitch control to an external control FREQUENCY. This control frequency may be generated from either a synthesizer VCO, or a special Eventide keyboard (Model HK940) designed to lock to the Harmonizer master oscillator and provide precise musical intervals upon demand. The control provided by the phase locking circuitry is far more precise than that provided by the Control Voltage circuit, and should be used whenever precise control of pitch ratio must be effected by an external source. The input signal requirements for frequency lock are covered in the section describing rear-panel connections.

REMOTE CONTROL OPERATION

The Harmonizer has provision for digital remote control via an optional circuit board and IEEE-488 connector on the rear panel. In normal (NON-REMOTE) operation, the LED adjacent to each of the CONTROL MODE switches mentioned above will illuminate RED when its corresponding switch is depressed. When the Harmonizer is operating under REMOTE CONTROL, whichever of the modes is active will be illuminated GREEN, both to signify the active MODE and to signify that the REMOTE CONTROL is determining the FUNCTION and CONTROL MODEs. The simultaneous illumination of all three GREEN lights signifies that the PITCH RATIO is being determined by the remote control unit and not by the front panel controls or rear panel inputs.

FUNCTION SELECT SWITCH GROUP

The FUNCTION SELECT push ON/push OFF switch and the four switches immediately to its right select the OPERATING MODE (as opposed to the control mode, described above) of the H949. This switch group determines, for instance, whether the unit is going to perform a pure delay or a pitch change function. The FUNCTION SELECT switch itself qualifies the operation of the actual control switches to its right. When the FUNCTION SELECT switch is OUT, the four controls select the functions labelled in GREEN immediately ABOVE each switch. When the switch is IN, the four controls select the functions labelled in RED immediately BELOW each switch. The RED/GREEN LED's above each of the four switches indicate which function is active by both selective illumination (only one of the four is ON), and by selective color (if the LED is RED, the function BELOW the switch is activated, if GREEN, the function ABOVE the switch is active).

The FUNCTIONS controlled by these four switches fall into two major groups: PITCH CHANGE EFFECTS (activated when the FUNCTION SELECT switch is IN, RED labels), and DELAY/REVERSAL effects (activated when the FUNCTION SELECT switch is OUT, GREEN labels. For clarity, the operation of the four switches will be described with relation to these two groups, rather than by discussing the functions of each physical switch.

PITCH CONTROL GROUP (RED)

When the FUNCTION SELECT is IN, the lower, RED labels of the function switches are effective. The leftmost switch, labelled "NORM", places the Harmonizer in the normal pitch change mode. Adjusting the MANUAL control over its full range gives pitch ratios from .25 (two octaves down) to 2.0 (one octave up. Note that the readout may exceed these ratios at the control extremes.

To assure adequate variation, the control is factory adjusted to provide extra range at each end. Although it is usually possible to dial ratios beyond the extremes given in the specifications, certain undesirable effects may become apparent: At the LOW end, decreasing the pitch ratio may increase the noise level, manifest symptoms of aliasing or heterodyning, and create other unpleasant digital sounding effects. At the HIGH end, increasing the reading beyond 2.00 will NOT increase the pitch ratio, but WILL create small amounts of undesirable phase noise.

The EXTENDed PC mode permits selection of the length of signal segment over which the pitch change algorithm operates. The NORM pitch change mode operates with a delay variation of approximately 25 milliseconds (see Theory of Operation). Depressing EXTEND allows extension of this segment to the full extent of the Harmonizer memory, or some fraction thereof, depending upon the setting of the MAIN OUTPUT (MSEC) DELAY SET SWITCHES. (Normal operation of these switches is discussed under the next GROUP heading.) Special operations of these controls is also mentioned here, and under the REVERSE FUNCTION heading. When the rightmost three of these switches are physically OUT (normally inactive), the EXTENDed pitch memory segment covers the entire memory, 400 milliseconds. Depressing the 200 MILLISECOND (rightmost) switch cuts this memory segment by 200 milliseconds, to a total of 200 milliseconds. Depressing the 100 MILLISECOND switch (next to rightmost), the memory segment is DECREASED by 100 milliseconds, thus giving a total memory segment of 100 milliseconds. Depressing the 50 MILLISECOND switch decreases the memory segment to 50 milliseconds. Note that the operation of these switches may be regarded as reversed from their normal operation: Depressing the 200MS, 100MS and 50MS switches RESTRICTS the memory segment used by the pitch change mode by the amount indicated. If the 200MS switch is released (OUT), depressing the 100MS or 50MS switch will have no effect. If the 100MS switch is OUT, depressing the 50MS switch will have no effect.

UPC (MICRO PITCH CHANGE) modes, SHARP AND FLAT. These modes operate in a manner similar to the NORM PITCH CHANGE function, except that the range of pitch ratios is restricted to about 1:1.07 (SHARP) and 1:.93 (FLAT). Depressing the SHARP button allows adjustment of the pitch ratio from almost exactly 1:1 (unison) to approximately 1:1.07, corresponding to more than a musical "semitone". The pitch is adjusted using the MANUAL control, which now operates nonlinearly, so that as it is rotated closer to 1:1, the pitch change per degree of rotation decreases. This permits extremely fine and stable control of pitch ratios close to unity. It is easily possible to obtain an adjustment of 1 001 to 1, and have this remain stable over time and temperature within 1 per cent. This is better than an order of magnitude improvement over previously available units.

Depressing the FLAT button gives an adjustment range of approximately 1:1 to 1:.93, or more than one "semitone" down. Again, as the ratio approaches 1:1, the sensitivity of the ratio to the knob rotation decreases.

Note: For both SHARP and FLAT operation of MICRO PITCH CHANGE, the PITCH RATIO is closest to 1:1 when the MANUAL control is fully counter-clockwise. In SHARP, clockwise rotation INCREASES the pitch. In FLAT, clockwise rotation DECREASES the pitch.

DELAY/RANDOM/FLANGE/REVERSE FUNCTIONS (GREEN)

When the FUNCTION SELECT is OUT, the upper, GREEN labels of the function switches are effective. The first of these is the DELAY switch. When this switch is depressed, the MAIN OUTPUT acts like the DELAY ONLY output, and the IN/OUT pitch ratio remains at unity. The time delay is set by the MAIN OUTPUT (MSEC) switch group as described later.

Note: When in the DELAY mode, the MANUAL control affects the PITCH RATIO readout in the same manner as when the unit is in the NORM (PITCH CHANGE) mode. This is useful if one desires to pre-set the pitch ratio without changing the output signal: releasing the FUNCTION SELECT switch immediately acquires the selected pitch ratio. Remember: in the DELAY MODE, the pitch always remains at UNITY, regardless of other control settings or the PITCH RATIO readout.

RANDOM FUNCTION SELECT switch

Depressing this switch causes the MAIN OUTPUT to vary its delay between the maximum limits of 0 and 25 milliseconds at a constant rate of delay change. The actual delay limits, while restricted to the range given above, will typically be smaller on any given excursion. The range is determined in a "pseudo-random" manner by the Harmonizer's digital circuitry, and the effect created by using this mode closely simulates the random variations experienced when having individual performers "double" tracks, or having multiple musicians or singers performing simultaneously. Use of this operating mode is advantageous for "automatic double tracking" (ADT) because it gives a less "mechanical" sound than does fixed delay.

In the RANDOM MODE, the MANUAL pitch control varies the rate at which the delay varies from the upper to lower limit. Clockwise rotation increases the rate. Because the pitch varies slightly as the delay changes, the desirable effect of having the singers/performers very slightly out of tune is automatically achieved. The degree of pitch change may be reduced to a very small amount with the MANUAL control if so desired.

FLANGE FUNCTION Switch

This switch sets the Harmonizer into an automatic flanging mode. "Flanging" is the effect created when two signals of slightly differing delays are added together, while the delay of one signal is varying. (Delays on the order of 0 to 10 milliseconds are used. The lowest frequency affected is roughly the reciprocal of the time delay, so that a one millisecond delay causes cancellations at 1KHz and multiples thereof.) In the FLANGE mode, the MANUAL control varies the SWEEP rate, or the rate at which the delay of the variable delay signal is changing. Turning the MANUAL control clockwise increases the sweep rate.

Note: It is NOT necessary to mix the outputs of the MAIN and the DELAY ONLY outputs externally to achieve flanging. The DELAY ONLY output is unaffected by the FLANGE MODE, and the MAIN OUTPUT signal is flanged automatically.

RANDOM and FLANGE MODE NOTE:

To achieve normal FLANGING and RANDOM MODE operation, it is necessary for the ALGORITHM SELECT switch to be in the ALGORITHM 2 (physically OUT) position. If it is in the ALGORITHM 1 position, the output amplitude will vary with time and an extra delayed signal may be heard. The purpose of the ALGORITHM SELECT control is discussed later.

REVERSE FUNCTION switch

The final function switch controls the REVERSE mode of the Harmonizer. Activating

this mode causes the data entered into the memory to be read out backwards, so that short signal segments (up to the memory capacity of the Harmonizer) are presented in a time reversed order. The tape recorder analogy would be equivalent to cutting up a tape into 6 inch segments (at 15 inches per second) and then splicing the segments back into the same order after reversing the individual segments. Obviously this effect cannot reverse the time-order of entire programs as can playing a tape backwards, but the overall effect is the same except for signals which have very long attack or decay times.

The MANUAL pitch change control is active in the REVERSE mode and the pitch of the reversed signal may be altered within the same limits defined for the NORMal PITCH mode. There is no corresponding MICRO PITCH CHANGE mode for the REVERSE function.

Note that the REVERSE mode normally spans the entire Harmonizer memory of 400ms. If it is desired to reduce the length of signal segment acted upon by the reverse mode, one may restrict it by depressing the MAIN OUTPUT (MSEC) delay select switches as described in the EXTENDed PC mode. Depressing the 200MS button reduces the segment length to 200 milliseconds. Depressing the 100MS button reduces the segment length to 100 milliseconds, and depressing the 50MS button reduces the segment length to 50 milliseconds.

MAIN OUTPUT (MSEC) DELAY SET SWITCH GROUP

This group of 6 push/ON push/OFF buttons controls the delay of the MAIN OUTPUT. Depending upon the FUNCTION SELECTed, the switches may have other effects (see EXTENDed PITCH mode and REVERSE mode.) In the DELAY mode, all of the switches are active, and they operate in a manner precisely analogous to the DELAY ONLY OUTPUT (MSEC) switch group described earlier. In the DELAY mode, the MAIN OUTPUT DELAY is equal to the sum of the individual switches depressed.

In the NORM, MICRO PC, RANDOM, and FLANGE modes, only the last three switches are active. This is because the delay variation required by these functions is greater than the small increments of delay otherwise permitted. The MAIN OUTPUT, WITH THE EFFECT SELECTED, will be displaced by 50 to 350 milliseconds from its normal location in time, in accordance with the buttons depressed.

ALGORITHM SELECT 1/2

The ALGORITHM SELECT control determines the method the Harmonizer employs to handle the "glitches" which are a theoretical and practical consequence of the pitch change process. The word "algorithm" is defined as a precise, describable process which acts upon or modifies inputs in a specific manner. An algorithm may be simple or complex, although it must be defined under all circumstances. The characteristics of the two algorithms are described in greater detail in the Theory of Operation section.

Algorithm 2 is similar to that used in the Eventide Model H910 Harmonizer. It is characterized by "glitches" which occur at increasing frequency as the pitch ratio deviates from 1:1. Algorithm 1 does not produce glitches, but there is a varying degree of signal "coloration". For pitch ratios below .5 (one octave), algorithm 2 may produce hard "glitches" or clicks, and so algorithm 1 should be used at such extreme pitch errors.

Note: The proper selection of pitch change algorithm is a significant factor in the degree of success with which one can expect to modify the pitch of performed or recorded material. We recommend experimentation as the final arbiter of which is appropriate for any given program material and pitch ratio. The two algorithms converge in audible effect as the pitch ratios approach an octave in either direction, and both will perform identically at these extremes.

NOTE: See page 15 for use of the LU618 De-Glitch optional add-on board

FUNCTION	ALGORITHM	PITCH RATIO	CONTROL MODE
DELAY	-	.25-2.00	MAN,CV+M,KYBD
RANDOM	2 *	.99-1.01	MAN,CV+M
FLANGE	2 *	.99-1.01	MAN,CV+M
REVERSE	1 OR 2	.25-2.00	MAN,CV+M,KYBD
NORMAL PITCH CHANGE	1 OR 2	.25-2.00	MAN,CV+M,KYBD
EXTENDED PITCH CHANGE	1 OR 2	.25-2.00	MAN,CV+M,KYBD
MICRO PC SHARP	1 OR 2	1.0-1.1	MAN,CV+M
MICRO PC FLAT	1 OR 2	1.0-.90	MAN,CV+M

* Using algorithm #1 adds an extra delay to the output.

H949 Harmonizer - Chart showing which algorithm, pitch ratio, and control modes are operative for different functions.

REMOTE CONTROL

There will shortly be available a remote control option for the H949 which uses the IEEE/488 General Purpose Interface Bus to interface with a microcomputer. If information is not already printed in this manual, sending in the Warranty Card from the front of the manual will ensure that you are sent the information as soon as it becomes available.

VOLTAGE CONTROL OF PITCH RATIO

It is possible to remotely control the H949 Harmonizer pitch ratio by supplying a control voltage in the range from 0 to +10 VDC. An internal adjustment allows setting of the control voltage full scale between +5 VDC and +10 VDC, making it compatible with various synthesizers. The control voltage should be applied between terminal strip pins 10 and 11, with pin 11 being more positive. Care should be taken to ensure that the control voltage is as pure and free of ripple as possible, to avoid frequency modulation of the pitch shifted signal.

For your convenience, a source of clean +12 volts, current limited by a 10 k resistor, is available at pin 12 of the terminal strip. The equivalent input circuit at the CV IN pin is a 10 k resistor in series with an operational amplifier non-inverting input. Therefore, voltages within the range 0 to +12 will be feeding

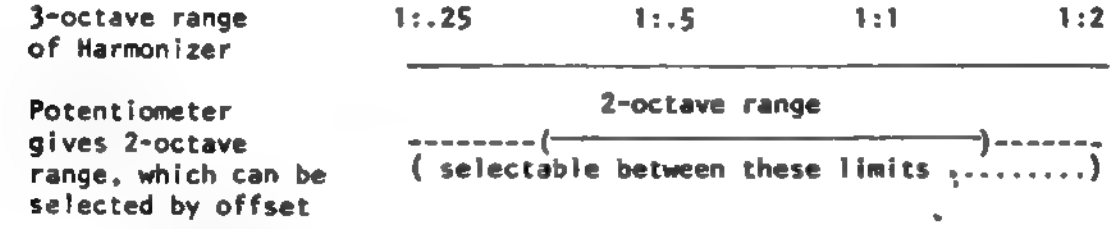
an essentially open circuit. Exceeding +12 volts will cause current to flow into the input, limited by the resistor. Greatly exceeding +12 volts may damage the input, and should be avoided.

Control voltage range adjustment

To adjust the external control voltage range, remove the Harmonizer top cover and swing the top board up on its hinges. The adjustment (labelled ECV LV) is a small trim resistor located about 3 cm in front of the keyboard Molex connector on the bottom circuit board.

RESISTIVE CONTROL OF PITCH RATIO

A remote control may be provided simply by connecting a 100 k potentiometer between terminal strip pins 12 and 10 and connecting the wiper to pin 11. The unit is factory set so that this connection will cover a two-octave range. The front panel manual pitch ratio control will provide an offset, enabling this two-octave range to be selected from the three-octave range of the Harmonizer.



Note: The maximum input voltage in this configuration is 10 volts.

FREQUENCY CONTROL OF PITCH RATIO

In addition to voltage control, the Harmonizer may be externally varied in pitch ratio by applying an input frequency from a signal generator, synthesizer, or other source. This mode is preferable to the Control Voltage mode for musical applications as the input frequency is precisely related to the pitch ratio, i.e., if the input frequency is increased by one interval, the pitch ratio likewise increases by one interval.

Signal requirements

The input frequency must be spectrally pure in that only the fundamental and its harmonics may be present. The unit will not accept signals with more than one fundamental frequency present, and should not be driven by any source from which a clean, constant signal level cannot be guaranteed. Function generator/synthesizer waveforms such as sine, square, and triangle waves are all acceptable.

The input voltage should be at least 5 volts peak to peak for a sine wave, and at least 3 volts for a square wave. All standard logic families meet these requirements.

Input frequency for unit pitch ratio is 2.5 kHz. Increasing or decreasing the input frequency by up to one octave up, or two octaves down, produces a corresponding change in the pitch ratio.

Tuning

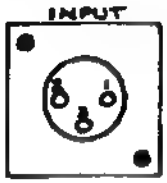
When using the Harmonizer with a customer-supplied keyboard, it may be necessary or desirable to re-tune the keyboard for a pitch ratio of 1.00 when middle C is depressed.

REAR PANEL CONNECTIONS

AC POWER CONNECTOR

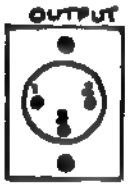
This connector accepts an internationally-approved IEC connector. The line cord furnished with the unit is for United States standard 3-wire outlets. The line voltage is specified on the serial number plate. It may be changed from 120 VAC to 240 VAC (or vice versa) by sliding the clear panel over the AC connector, removing the small printed circuit board, turning it round, reinserting it, and changing the fuse to the correct value (½ amp for 120 VAC, 3/8 amp for 240 VAC, slo blo type).

INPUT CONNECTOR (3-pin XLR female)



This is the audio input connector for the H949 Harmonizer.
Refer to the Specifications for levels and impedances.

OUTPUT CONNECTORS (3-pin XLR male)



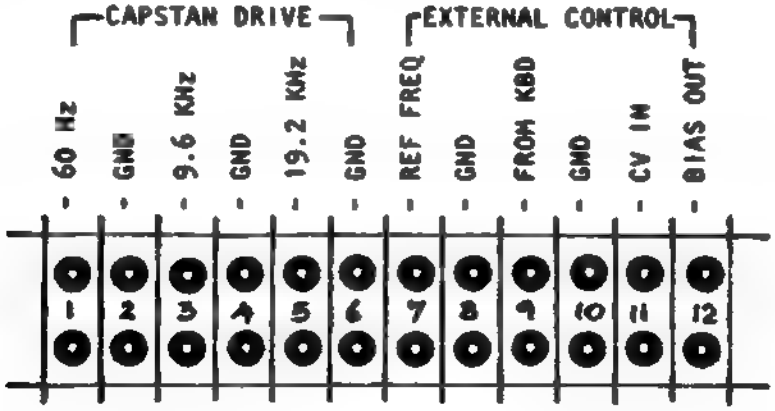
Each output has an output connector for audio.
Refer to the Specifications for levels and impedances.

Pin 1 is shield/chassis ground
Pin 2 is output - phase
pin 3 is output + phase

KEYBOARD CONNECTOR, REMOTE CONTROL (IEEE/488) CONNECTOR

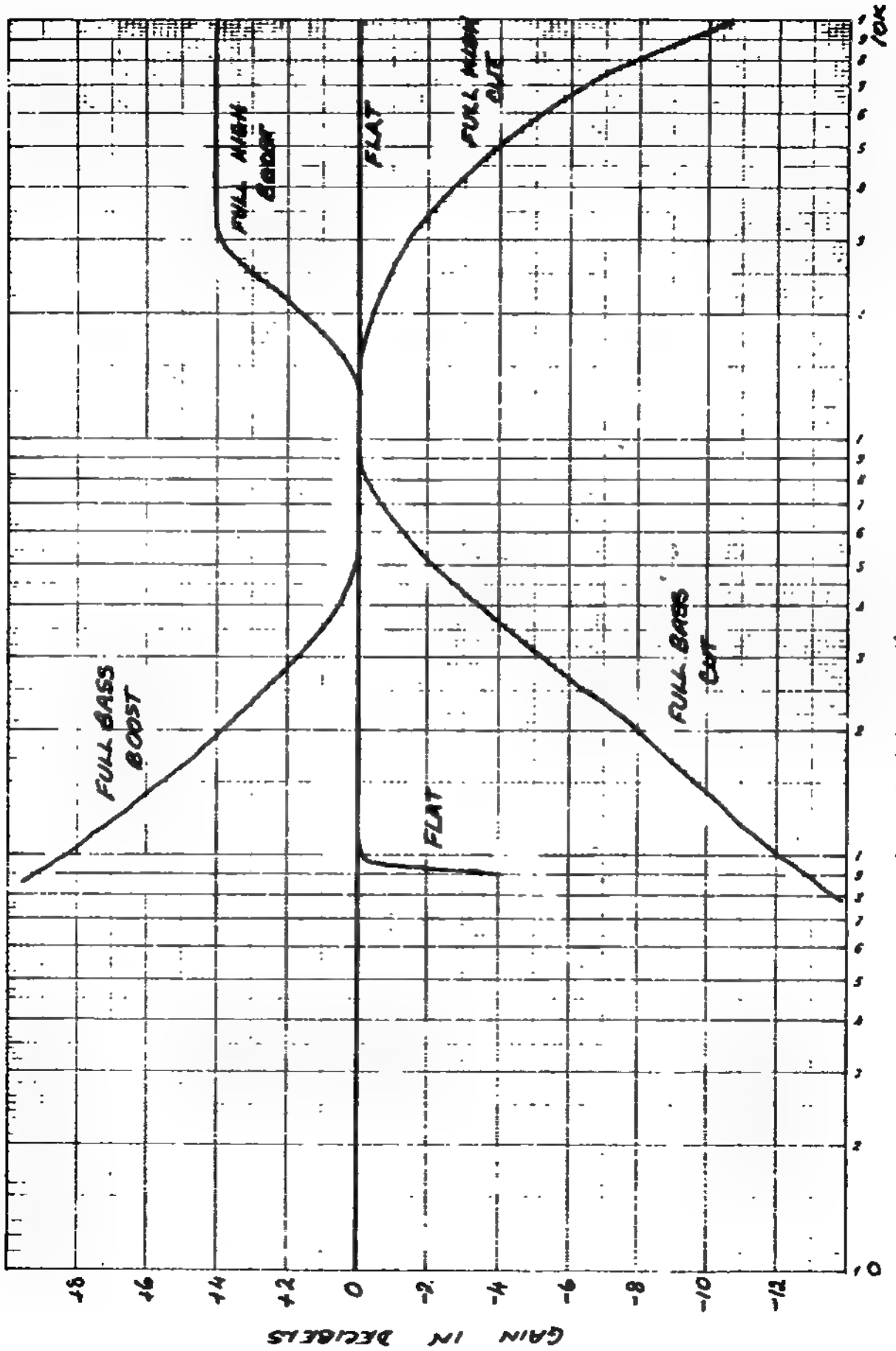
Refer to Keyboard and Remote Control sections of manual for details.

CAPSTAN DRIVE AND EXTERNAL CONTROL TERMINAL STRIP



GROUNDING

As with any piece of audio equipment, good grounding practices should be followed when connecting the unit. The grounds should be connected insofar as possible as shown above. This will help prevent ground loops and subtle troubles that can occur when equipment to be interconnected is at differing ground potentials. A sure sign of grounding problems is if an unexplained hum or buzz is present even when the LINE switch of the Harmonizer is in the OUT position. The LINE switch bypasses the unit with a DC path, and is independent of whether power is applied. While the Harmonizer is susceptible to certain faults and component breakdown, it is unlikely that generating hum or buzz is among them. If the unit seems to be contributing such a signal, and there is no evidence that the power supply is faulty, check your grounding scheme first of all. Incidentally, this applies to almost all accessory equipment.



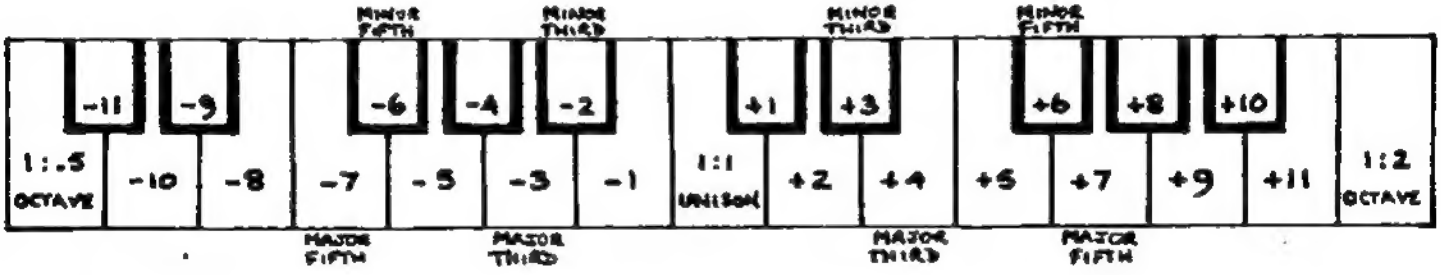
FEEDBACK EQUALIZATION FREQUENCY RESPONSE

PITCH RATIO READOUTS FOR VARIOUS MUSICAL RELATIONSHIPS

-3/4	-1/2	-1/4	NOTE	RELATIONSHIP	NOTE	+1/4	+1/2	+3/4
.958	.972	.986	1.000	UNISON	1.000	1.015	1.029	1.044
.904	.917	.930	.944	-1 +1	1.060	1.075	1.091	1.106
.853	.866	.878	.891	-2 +2	1.123	1.139	1.155	1.172
.805	.817	.829	.841	-3 +3	1.189	1.207	1.224	1.242
.760	.771	.782	.794	-4 +4	1.260	1.278	1.297	1.316
.717	.728	.738	.749	-5 +5	1.335	1.354	1.374	1.394
.677	.687	.697	.707	-6 +6	1.414	1.435	1.456	1.477
.639	.648	.658	.667	-7 +7	1.498	1.520	1.542	1.565
.603	.612	.620	.630	-8 +8	1.587	1.611	1.634	1.658
.569	.578	.586	.595	-9 +9	1.681	1.706	1.731	1.756
.537	.545	.553	.561	-10 +10	1.781	1.808	1.834	1.861
.507	.515	.522	.530	-11 +11	1.888	1.915	1.943	1.971
.479	.486	.493	.500	OCTAVE	2.000			
.452	.459	.465	.472	-13				
.427	.433	.439	.446	-14				
.403	.407	.414	.420	-15				
.380	.381	.391	.397	-16				
.359	.364	.369	.375	-17				
.339	.344	.349	.354	-18				
.320	.324	.329	.334	-19				
.302	.306	.310	.315	-20				
.285	.289	.293	.297	-21				
.269	.273	.277	.281	-22				
.254	.257	.261	.265	-23				
			.250	TWO OCTAVES				

Note: The lowest octave is only available with the H949.

For use with the H910 Harmonizer, round off the figure to two decimal places.



PITCH CHANGE

The Eventide Harmonizers model H910 and H949, and 1745M Delay Line with Pitch Change Module may be used to generate musical harmonies by reference to the above table. Because a digital compression or stretching process is used, all harmonic relationships are preserved, unlike the disharmony produced by heterodyne-type 'frequency shifters'.

For example, suppose two frequencies, originally in a musical relationship, are shifted up by 100 Hz. Although the absolute difference between the signals remains constant, the musical interval between them decreases. However, if the two frequencies are *multiplied* by any constant, as in the Harmonizers and Pitch Change Module, the interval remains constant, even though the absolute difference will change.

TEMPO REGULATION

The internal oscillator of the 1745M and the H949 Harmonizer provides an output frequency which may be used to control the speed of a tape recorder. The H910 Harmonizer does not have this facility.

The H949 back panel terminal strip provides output frequencies of 19.2 kHz, 9.6 kHz, and 60 Hz. These are three of the major standards for servo-controlled tape machines.

When the tape machine is being controlled by the H949 capstan drive output frequency, a pitch ratio of unity (1.000) will result in the tape running at normal speed. A ratio above unity will result in a slower tape speed, and a pitch ratio below unity in a faster tape speed.

One of the primary uses of this feature is in time compression. Suppose, for example, that you have a commercial which is intended for a 60-second time slot, but the commercial actually runs for 62 seconds. The required pitch ratio may be ascertained as follows:

60 / 62 = 0.968 (rounded to four digits)

The tape speed will be increased slightly.

If, as is usually the case, the required pitch ratio falls into the range from 1.08 to 0.92, it is recommended that you use the MICRO PITCH CHANGE mode, which will avoid any tape speed problems (see note below), and also help to stabilize the pitch setting.

Because of the Harmonizer 'glitch', it may be advisable to record the passage more than once, and select the best portions from each recording.

NOTES:

See Technical Section page T3 for instructions on aligning the CAP CAL trimpot.

Depending upon the input drive requirements of the tape machine, it may be necessary to buffer the H949's capstan drive output with an external amplifier.

VERY IMPORTANT. While pitch ratios above unity will not cause the tape machine any problems, it is essential to remember that, if normal tape speed is 30 ips, a pitch ratio of .5 (one octave down) will result in a tape speed of 60 ips, and a pitch ratio of .25, two octaves down, will result in a tape speed of 120 ips and almost certain chaos!

On the next page you will read some information about two additions for the H949 Harmonizer, both of which are very useful for time compression applications. YOU WILL RECEIVE FURTHER INFORMATION ON THIS AND OTHER NEW PRODUCTS IF YOU RETURN YOUR WARRANTY CARD (which is at the beginning of the manual).

Eventide
the next step

DE-GLITCH AND REMOTE OPTIONS FOR H949 HARMONIZER

LU618 DE-GLITCH BOARD FOR H949 HARMONIZER

The LU618 is a signal processor/analyzer board which eliminates almost completely the "glitching" characteristic common to all pitch change devices which operate by eliminating or adding signal segments. This computerised addition to the H949 determines the optimum splicing point, thus reducing the potential "glitch" to inaudibility in most cases.

As the LU618 board uses a degree of "intelligence" to decide the optimum splicing point, it works best on single-instrument program material. If the program material is too "busy", the improvement may not be as great.

The LU618 board mounts just underneath the HD921 digital board inside the H949 Harmonizer. If this board has been installed at the factory, the serial number plate of the unit will read "option: ALG.3".

The "de-glitch" mode is in operation when ALGORITHM 2 is selected.

Algorithm 1, which gives a somewhat softer splice, resulting in a tremolo effect, may be preferred for certain special effects. We suggest that you experiment to see which suits your program material best.

NOTE: The de-glitch splicing method is only operative in NORMAL and MICRO PITCH CHANGE. It is not operative in REVERSE or EXTEND modes.

As the de-glitch board makes the H949 Harmonizer almost entirely glitch-free, it will probably tend to be the preferred setting for most work.

The LU618 de-glitch board may be added in the field to any H949 Harmonizer with a serial number after A949-1606. It may be added to earlier units at the factory. Call Eventide or your local dealer for price and delivery.

COMPUTER REMOTE CONTROL BOARD FOR H949 HARMONIZER

This board enables almost all the functions of the H949 Harmonizer (including pitch change) to be controlled by an external computer. The board uses the IEEE-488 standard, which permits multiple units to be controlled individually on a single bus, thus reducing the cost and complexity of interconnection.

The board is completely compatible with the IEEE-488 standard, and can be controlled by low-cost home computers (such as the Commodore PET or Hewlett-Packard model 85), as well as by several automated consoles and industrial computers.

Harmonizer is Eventide's trade name for a special effects device including pitch change.

THINGS NOT TO WORRY ABOUT

This is a list of things which may seem strange but are really normal in the H949 Harmonizer.

* The rear panel regulator is exposed, yet mounted on a mica insulator. The insulator is to prevent hum in the output. THERE IS NO EXPOSED HIGH VOLTAGE on the regulator.

* When switching from PITCH to DELAY, it is not unusual to observe a small level shift (a fraction of a dB). This is of no consequence, either in operation or for maintenance. If the level shift exceeds 1 dB, it should be investigated. (See Alignment Section.)

* The PITCH RATIO READOUT will occasionally flash (blank) for a few milliseconds between readings. This is a characteristic of the counter chip, and should be ignored. Frequent blanking, several times in a ten-second period, may be indicative of a readout problem. This will RARELY IF EVER create an AUDIO problem.

* The LAST DIGIT of the readout will usually vary +/- one digit. This is a theoretical consequence of digital counting and does not indicate a corresponding variation in pitch ratio. In the UPC (micro pitch change) mode, the last digit may also DRIFT over time and temperature, and in the NORMAL PC mode, the second-from-last digit may drift over time and temperature. A variation of .1% in UPC and 1% in NORMAL PC is within tolerance. Excessive drift may be caused by unusually high line voltage, or lack of ventilation, or by defective components.

* Power line outages, or turning the Harmonizer OFF and then ON rapidly may initiate a mode of operation in which the UPC directions are reversed (flat becomes sharp) and FLANGE and RANDOM do not work. This occurs because the power ON reset circuitry requires time to discharge on power OFF. This problem may be remedied by turning the unit OFF for about five seconds before turning it ON again.

* The SIGNAL PRESENT LED does not go on at a precisely defined level, but rather is intended to show that a signal is present. It should always be OFF when the input level control is at zero, or there is no input signal (providing that the FEEDBACK controls are off). It should always be ON when the input signal exceeds -30 dB with respect to clipping. It may come ON at any level between these broad limits.

* It is possible, but very unlikely, for the PITCH CHANGE circuitry to go 'out of sync', introducing distortion at the main output. If this happens, the circuitry can be reset, either by changing the main output function, or by turning power OFF, waiting five seconds (see above) and then ON again.

* When operating in the External Control modes, the pitch ratio readout may indicate ratios above 2.00. However, the actual ratio will be limited to 2.00, regardless of the reading. Note that the pitch ratio readout continues to operate even in the DELAY mode. This is of advantage because it permits one to set a precise ratio and then switch from DELAY to that ratio by going into the PITCH CHANGE mode.